1077-39-113 **Kenneth R. Ball*** (krball@ncsu.edu), Box 8205, NCSU Campus, Raleigh, NC 27695, and **Dmitry V. Zenkov**. *Difference equations for long-term simulation of mechanical systems.* Preliminary report.

The importance of preservation of various structures of mechanical systems by discrete models has long been acknowledged. It is possible to interpret the dynamics of a mechanical system as a variational problem. Discretizations of variational formulations – as opposed to discretizations of the corresponding differential equations of motion – lead to difference equations that acknowledge these structures and demonstrate good long-term behavior. In this talk we will discuss the extension of this strategy to systems with velocity constraints (such as non-slip conditions on carwheels) using suitable variational principles and show that the resulting difference equations correctly model the constraints. (Received July 27, 2011)